

18.0 LOWER COLUMBIA RIVER (*O. MYKISS*) ESU

18.1 BACKGROUND

18.1.1 Description of the ESU

The Lower Columbia River (LCR) *O. mykiss* (steelhead) ESU includes winter and summer steelhead populations from the Cowlitz River to the Wind River (inclusive) in Washington and from the Hood River to the Willamette River in Oregon (excluding steelhead above Willamette Falls). The Willamette/Lower Columbia River TRT (WLC-TRT) partitioned the LCR steelhead populations into a number of strata based on major life history characteristics and ecological zones (McElhany *et al.* 2003). The strata and associated historical populations are identified in Table 1. There is still some uncertainty whether winter steelhead in the Scappoose and Milton Creek basins are part of this ESU or the Southwest Washington steelhead ESU.

18.1.2 Current Status of the ESU

There are 28 steelhead propagation programs that release fish within the Lower Columbia River steelhead ESU. Only seven of these release steelhead that are considered to be part of the LCR steelhead ESU (Table 1). These seven programs are primarily designed to mitigate for lost harvest opportunities and to secondarily augment the natural spawning populations in the basins where the fish are released. The remaining 21 programs operate under the obligation to replace steelhead from areas taken out of production by hydro-power development. Most of these steelhead propagation programs are designed to mitigate for lost fisheries and not to seed accessible production areas.

18.2 Assessment of the Hatchery Programs

18.2.1 Cispus River Winter Steelhead Population; Tilton River Winter Steelhead Population; Upper Cowlitz River Winter Steelhead Population; Lower Cowlitz River Winter Steelhead Population

18.2.1.1 Cowlitz Late Winter Steelhead Program

18.2.1.1.1 Broodstock History. With the construction of Mayfield Dam, many of the adults returning to the Cispus, Tilton, and Upper Cowlitz rivers were taken into the Cowlitz Trout Hatchery to establish the late winter steelhead broodstock. The hatchery has also collected adults returning to the Lower Cowlitz winter steelhead population into the broodstock. Broodstock is collected from volunteers to the Cowlitz Trout Hatchery and at the Barrier Dam. Naturally produced late run winter steelhead and those steelhead from releases in the upper Cowlitz River basin can be separated at the Barrier Dam (unmarked and RV marked) and transferred to the upper basin or used for broodstock.

18.2.1.1.2 Similarity between Hatchery-origin and Natural-origin Fish. Other stocks of steelhead continue to be released into the Lower Cowlitz River basin (non-ESU summer

steelhead and early winter steelhead), and these may have integrated with program late run winter steelhead. However, genetic analysis indicates that the late winter steelhead stock is similar to other naturally produced steelhead from the Cascade Winter Steelhead Strata (Meyers et al. 2003). The program steelhead stock best represents what was historically present in the basin.

18.2.1.1.3 Program Design. The program is designed to contribute to fisheries and conserve/recover the local winter steelhead populations as mitigation for hydro-system impacts and habitat loss. The total production goal is 390,000 smolts, of which 75,000 are to be released into the upper Cowlitz and Cispus River (all right ventral fin-clipped). The smolts released into the lower Cowlitz River are all adipose fin-clipped to allow for selective harvest and to support identification at the barrier dam. The current hatchery program is supplying surplus adults for release into the upper basins. Juvenile parr releases were ended in 2003, because enough adults were returning to support natural production, and it would assist in the evaluation of productivity of habitat in the upper basin. Smolt releases will continue to assist in the analysis of fish collection and passage at Cowlitz Falls Dam. All steelhead surplus to broodstock needs are divided between the Tilton River and the upper Cowlitz River (both Cispus and upper Cowlitz populations), with 25 percent going to the Tilton and 75 percent going to the upper Cowlitz River. Juveniles outmigrating from the different basins are collected and uniquely marked, so they can be identified with their basin of origin when they are collected at the Barrier Dam. It is proposed under the draft Fish Hatchery Management Plan for the Cowlitz River to end the release of program adults into the upper Cowlitz when there are 800 naturally produced adult returns to the upper basin, in order to test if the population can be self-sustaining. Over the term of the evaluation, if naturally produced adults decline below 800, the difference will be made up with program fish. A similar plan is proposed for the Tilton basin.

18.2.1.1.4 Program Performance. The reintroduction of steelhead in the upper Cowlitz River began at a small scale in 1995-96 with small releases of hatchery and unmarked steelhead. In the past few years, WDFW has been passing upstream more than the 800 adults proposed in the evaluation. Releases of surplus adult program steelhead have allowed for selective recreational fisheries and are used to test assumptions regarding distribution and habitat productivity. In 2003, WDFW passed upstream into the upper Cowlitz 523 unmarked, 579 RV-marked (returning adults from juveniles released into the upper basin), and 1,433 adipose fin-clipped program steelhead adults. These numbers have been steadily increasing since adult releases began at a larger scale in 1999 (52 unmarked, 42 RV, and 63 program fish) (John Serl, WDFW emails 4/9/04 and 3/14/03). A similar trend is also occurring for the Tilton River basin, but this didn't begin until 2002. In the last few years, an average of 150-200 naturally produced adults have returned to the Tilton River annually. Natural production by the upper basin populations is reflected by the number of unmarked steelhead juveniles that have been collected at Cowlitz Falls Dam: 30,861 in 2001, 9,300 in 2002, and 14,729 in 2003. Stray rates into to lower Cowlitz River tributaries and overall survival have not been determined for program steelhead. Program fish released into the lower river are not uniquely marked from other hatchery program (summer and early winter) steelhead releases.

Tacoma Public Utilities funds the operation of the program, and BPA funds the research at Cowlitz Falls Dam and the stress relief ponds below the barrier dam. This program is funded as

mitigation for hydro-system operation in the Cowlitz River basin and is expected to remain funded for the life of the project license. The hatchery program size and implementation will be adjusted during negotiations on the development of Fish Hatchery Management Plan for the Cowlitz River basin and will reflect natural production in the upper basin.

18.2.1.1.5 VSP Effects. These programs have increased the number of naturally spawning steelhead in the upper Cowlitz, Cispus, and Tilton rivers and have increased the spatial distribution of the reference populations into historical habitat. The program may have also increased the number of natural-origin late winter steelhead, as reflected by the number of unmarked adults collected at the barrier dam. There are questions as to whether the steelhead released above Cowlitz Falls dam will differentiate into distinct populations in the Cispus and the upper Cowlitz rivers. If they do, there is concern that it may be difficult to manage the hatchery program to integrate with all three populations and to act as a genetic reserve.

There are no data available to determine the contribution of Cowlitz Late Winter Steelhead program fish to the Lower Cowlitz River winter steelhead population. Population surveys are conducted on tributary streams in the Cowlitz Basin (South Fork Toutle, North Fork Toutle, and Coweeman rivers) but not in the mainstem below the hatchery. Increased returns in recent years, as reflected by the number of program fish passed upstream, would support the conclusion that program fish are contributing to natural spawning in the lower river. It is uncertain if this is providing a benefit to the reference population, if the program fish are overwhelming the remnant population, or if the naturally produced steelhead are the progeny of naturally spawning program fish.

18.2.1.2 Cowlitz Summer Steelhead Program

18.2.1.2.1 Broodstock History. Broodstock for the summer steelhead program was derived from the Skamania stock summer steelhead and is currently operated using hatchery-origin summer steelhead returning to the basin.

18.2.1.2.2 Similarity between Hatchery-origin and Natural-origin Fish. Summer steelhead are not native to the Cowlitz River basin, and program fish are not being used to develop a local stock. The program goal is to manage the summer steelhead as an isolated population for harvest.

18.2.1.2.3 Program Design. The goal of the program is to support recreational fisheries in the lower Columbia River and Cowlitz River downstream of the Barrier Dam based on marked hatchery fish. A second goal for the program is to develop rearing, releases, and harvest strategies that will reduce or eliminate natural spawning of program summer steelhead. The annual production goal is currently 400,000 smolts that are released at the Cowlitz Trout Hatchery (Rkm 66.0). Another 30,000 smolts are acclimated at the stress relief ponds below the barrier dam (Rkm 78.9). Production has been reduced from 550,000 smolts released in 2002 to the current level. One concern is straying of recycled adults. A study of recycled summer steelhead observed recoveries in lower Cowlitz River tributaries and the North Fork Lewis, Kalama River, and North Fork Toutle Trap (Tipping 1998). The draft FHMP proposes to eliminate the recycling of summer steelhead, though this has not been agreed to by WDFW. WDFW wants to retain the option of recycling hatchery summer steelhead through the fisheries

during periods of low hatchery returns and low harvest. Summer steelhead can potentially interbreed with late winter steelhead. To determine if this has occurred, the draft FHMP proposes to collect genetic samples of unmarked steelhead spawning in the lower river and compare these to the late winter stock. Monitoring of naturally spawning steelhead in the lower Cowlitz River would also provide useful data on the portions of natural-origin and hatchery-origin summer and winter steelhead on the spawning grounds.

18.2.1.2.4 Program Performance. This program has been successful in meeting its primary goal of supporting recreational fisheries. The Cowlitz River below Mayfield Dam has been the top river segment in Washington for summer steelhead harvest in both 2000 and 2001 and consistently has ranked in the top ten. In 2000, over 7,100 summer steelhead were harvested in this section alone (WDFW Jan 2004). The harvest increased to almost 8,900 in 2002 (WDFW Feb. 2004). Smolt-to-adult survival rates have ranged from 3.09 percent in 1990 to 0.46 percent in 1995 (Cowlitz Summer steelhead APRE report 2003). The draft FHMP assumes an average smolt-to-adult survival rate of 1.9 percent when estimating production goals (FHMP 2004). A BRAP analysis of risks to the late winter steelhead population in the lower Cowlitz River from the summer steelhead program was conducted and four risks were identified: genetic risks due to interbreeding, ecological risks from predation and competition, ecological risks for disease transmission, and facility risks. All of these were rated low, except competition, which was rated high. This was due to the potential interactions of summer steelhead juveniles resulting from natural spawning of unharvested adults. The abundance of summer steelhead juveniles is currently unknown, but it has the potential to be substantial relative to winter steelhead abundance in the lower river (FHMP 2004). The number of unmarked summer steelhead returning to the hatcheries has been zero for the last three years and averaged less than 10 from 1998-99 to 2000-01. These low numbers may indicate that summer steelhead are not successfully spawning.

Tacoma Public Utilities funds the operation of the program as mitigation for hydro-system operation in the Cowlitz River basin and is expected to continue funding for the life of the project license. The hatchery program size and implementation will be adjusted during negotiations for the development of the Fish Hatchery Management Plan for the Cowlitz River basin and will reflect natural production in the upper basin.

18.2.1.2.5 VSP Effects. The summer steelhead program has the potential to adversely affect the viability of the Cowlitz River late winter steelhead populations. The primary concerns are interbreeding with the late winter steelhead in the lower river and ecological interactions between juveniles produced from naturally spawning summer steelhead and the late winter steelhead juveniles. Spawning time overlap is considered to be minimal, but the analysis of genetic samples will identify whether this is a concern. The BRAP analysis ranked as of low risk to the natural steelhead. The production of summer steelhead juveniles should be monitored to determine if there are negative interactions, even though low returns of unmarked summer steelhead may indicate that this is not a risk factor.

18.2.1.3 Cowlitz Early Winter Steelhead Program

18.2.1.3.1 Broodstock History. The stock of early winter steelhead is a combination of Chambers Creek, Elochoman River, and Cowlitz River winter steelhead. The program is currently operated using returns to the Cowlitz Trout and Cowlitz Salmon hatcheries.

18.2.1.3.2 Similarity between Hatchery-origin and Natural-origin Fish. The program goal is to manage the early winter steelhead as an isolated population for harvest.

18.2.1.3.3 Program Design. The goal of the program is to develop and implement rearing and release strategies that maximize the return of early winter steelhead to recreational fisheries and to the hatchery while minimizing interactions with natural-origin winter steelhead. The current program releases 300,000 early winter steelhead at the Cowlitz Trout Hatchery (Rkm 66). The draft FHMP (developed by Tacoma Public Utilities) has proposed to reduce the production to 200,000 smolts annually. Currently early winter steelhead returning to the Cowlitz Trout Hatchery are recycled downstream to allow for additional harvest opportunities. Studies have identified that early winter steelhead recycled into the lower Cowlitz River enter key tributaries where there is the potential for them to spawn naturally (Tipping 1998). Winter steelhead can potentially interbreed with late winter steelhead. To determine if this has occurred, the draft FHMP proposes to collect genetic samples of unmarked steelhead spawning in the lower river and compare these to the late winter stock.

18.2.1.3.4 Program Performance. Stray rates and smolt-to-adult survival has not been determined for this program, though studies have indicated that early winter steelhead from this program do stray into lower Cowlitz River tributaries. The program has been successful in supporting recreational fisheries. In 2000-01 and 2001-02, the Cowlitz River below Mayfield Dam was the river segment with the highest winter steelhead harvest in Washington (WDFW Harvest Summaries). The harvest in 2001-02 was almost 18,000 winter steelhead, including both early and late winter hatchery steelhead. The draft FHMP assumes an average smolt-to-adult survival rate of 1.9 percent when estimating production goals (FHMP 2004). A BRAP analysis of risks to the late winter steelhead population in the lower Cowlitz River from the early winter steelhead program was conducted, and four risks were identified: Genetic risks due to interbreeding, ecological risks from predation and competition, ecological risks for disease transmission, and facility risks. The BRAP ranked genetic risks as medium to high, citing that the potential for interbreeding between these two populations was likely to occur. The Cowlitz hatcheries have trapped an average of 248 unmarked winter steelhead over the past five years. This is an indication that early winter steelhead are reproducing naturally, but these could also be misidentified or incorrectly marked hatchery winter steelhead, as well. There is a concern that these could be passed upstream to the upper Cowlitz River basin and interbreed with late winter steelhead populations. WDFW has implemented protocols for separating early and late winter steelhead to minimize the potential for interbreeding, but it may be appropriate to collect genetic samples from steelhead during the period of potential overlap. The BRAP analysis also ranked the risk of competition as high, due to the potential interactions of early winter steelhead juveniles resulting from natural spawning of unharvested adults (FHMP 2004).

Tacoma Public Utilities funds the operation of the program as mitigation for hydro-system operation in the Cowlitz River basin and is expected to continue funding for the life of the project license. The hatchery program size and implementation will be adjusted during negotiations on the development of the Fish Hatchery Management Plan for the Cowlitz River basin and will reflect natural production in the upper basin.

18.2.1.3.5 VSP Effects. The net effect of this program on the viability of the late winter steelhead populations in the lower Cowlitz River is probably negative, though the magnitude of the impact to that natural population is probably not substantial. The primary concern is the potential for interbreeding between the early winter and late winter steelhead. Monitoring and genetic sampling will help determine whether this is occurring and if additional reforms are needed.

18.2.1.4 Friends of the Cowlitz Summer Steelhead Program

18.2.1.4.1 Broodstock History. The summer steelhead are from the Cowlitz Trout Hatchery summer steelhead program.

18.2.1.4.2 Similarity between Hatchery-origin and Natural-origin Fish. Summer steelhead are not native to the Cowlitz River basin, and program fish are not being used to develop a local stock. The program goal is to manage the summer steelhead as an isolated population for harvest.

18.2.1.4.3 Program Design. The cooperative program uses volunteers from the Friends of the Cowlitz to rear and release summer steelhead smolts to enhance recreational fisheries in the lower Cowlitz River. The program goal is for 100,000 smolts to be reared and then released from two locations in the lower Cowlitz River: the Toledo Sand and Gravel Pit (Rkm 42) and Wallace Pond (Rkm 54). The steelhead smolts are force-released from these locations. The goal of the program is to provide for additional harvest opportunities for summer steelhead in the lower Cowlitz River basin. Currently, the majority of the summer steelhead harvest occurs below the Cowlitz Trout Hatchery.

18.2.1.4.4 Program Performance. Smolt-to-adult survival rates have ranged from 3.09 percent in 1990 to 0.46 percent in 1995 (APRE reports). The draft FHMP assumes an average smolt-to-adult survival rate of 1.9 percent when estimating production goals (FHMP 2004). This program supports a very popular recreational fishery in the lower Cowlitz River below Mayfield Dam that had the highest summer steelhead harvest of any other river segment in Washington in both 2000 and 2001 and consistently has ranked in the top ten (WDFW Harvest Summaries). Risks for this program are the same as described above for the Cowlitz summer steelhead program. An additional concern with the releases of summer steelhead at these locations is the fate of those adults that are not harvested. A proposal has been made to investigate the feasibility of attracting, capturing, and hauling adults to remote locations to prevent them from spawning naturally. This action has been proposed through the HGMP development process.

Tacoma Public Utilities funds the operation of the program as mitigation for hydro-system operation in the Cowlitz River basin and is expected to continue funding for the life of the project license. The hatchery program size and implementation will be adjusted during

negotiations on the development of Fish Hatchery Management Plan for the Cowlitz River basin and will reflect natural production in the upper basin.

18.2.1.4.5 VSP Effects. The net effect of this program would be considered neutral unless program fish successfully spawn and produce juveniles that interact with the late winter steelhead populations. Low numbers of unmarked summer steelhead observed at the Cowlitz River hatcheries support the no-net-effect goals of the program relative to the listed population.

18.2.2 Coweeman River Winter Steelhead Population

18.2.2.1 Coweeman Ponds Winter Steelhead Program

18.2.2.1.1 Broodstock History. Winter steelhead for this program are delivered to the acclimation ponds from the Elochoman Hatchery. The Elochoman Hatchery winter steelhead are part of the Southwest Washington ESU.

18.2.2.1.2 Similarity between Hatchery-origin and Natural-origin Fish. The program goal is to manage the early winter steelhead as an isolated population for harvest.

18.2.2.1.3 Program Design. The program is designed to support recreational harvest as mitigation for hydro-system development and habitat loss. The cooperative program employs volunteers from the Lower Columbia River Fly Fishers to rear and release early winter steelhead smolts to enhance recreational fisheries in the Coweeman River. Steelhead are transported to two rearing ponds at Rkm 12.9 and Rkm 16.1 in March to be reared until they are forced out in late April to early May. The current production goal is 15,000 smolts from Pond #1 and 5,000 from Pond #2. WDFW is considering discontinuing this program, because access to the river is limited, which reduces harvest opportunities. WDFW is also concerned with interbreeding of early winter steelhead and natural-origin population in the basin. The BRT estimated that up to 50 percent of the naturally spawning winter steelhead are early winter steelhead (BRT July 2003). NOAA Fisheries would support discontinuing this program or, as an alternative, developing a program using natural-origin winter steelhead for broodstock.

18.2.2.1.4 Program Performance. Stray rates and smolt-to-adult survival rates have not been estimated for this program. The harvest of winter steelhead in the Coweeman River has averaged only 68 fish from 1998 to 2002. The catch-to-release ratio as was only 0.3 percent (APRE reports). McElhany et al. (2003) in its analysis estimated that 50 percent of the natural spawning population were program fish. Other estimates found that 27 percent of the natural spawning population were early winter hatchery steelhead (Wade 2000). This program is funded through the Mitchell Act, and future funding of this program is therefore uncertain.

18.2.2.1.5 VSP Effects. The net effect of this program is negative, because non-ESU early winter steelhead successfully spawn with the reference population.

18.2.3 South Fork Toutle River Winter Steelhead Population

18.2.3.1 Cowlitz Game and Anglers Summer Steelhead Program

18.2.3.1.1 Broodstock History. Summer steelhead for this program are from the Skamania Hatchery and are not part of the LCR steelhead ESU.

18.2.3.1.2 Similarity between Hatchery-origin and Natural-origin Fish. Summer steelhead are not native to the South Fork Toutle River. The program goal is to manage the summer steelhead as an isolated population for harvest.

18.2.3.1.3 Program Design. The program goal is to provide fisheries for summer steelhead in the South Fork Toutle River as mitigation for hydro-system development and habitat loss. Currently 25,000 summer steelhead smolts are transferred from the Skamania Hatchery and acclimated prior to release at the Cowlitz Game and Anglers Satellite Facility (South Fork Toutle Acclimation Ponds). Fish are released from mid-April to mid-May at 5 fish/lb. Skamania stock summer steelhead are used in this program because of the accelerated spawn timing for this stock. The goal is to temporally separate naturally spawning hatchery summer steelhead from the later spawning reference population. As with all Skamania stock summer steelhead programs, of primary concern are interactions between the reference population juveniles, and juveniles produced from naturally spawning summer steelhead. Increased monitoring of naturally spawning summer steelhead is recommended. Removal or spatial separation of returning hatchery summer steelhead from the natural-origin late winter steelhead should be investigated.

18.2.3.1.4 Program Performance. Stray rates and smolt-to-adult survival rates have not been determined for summer steelhead from this program. The sport harvest of summer steelhead in the South Fork Toutle averaged 560 adults from 1999-2001 (WDFW Harvest Summaries). Currently the South Fork Toutle is managed for natural production of winter steelhead and the contribution of hatchery steelhead to natural spawning is an estimated 17 percent for the period 1991 to 1996 (McElhany et al. 2003). It is unknown if those naturally spawning hatchery steelhead originated from this program. This program is funded through the Mitchell Act, and future funding of this program is uncertain.

18.2.3.1.5 VSP Effects. The net effect of this program would be considered neutral, unless program fish successfully spawn and produce juveniles that interact with the late winter steelhead populations. Low numbers of unmarked summer steelhead observed at the South Fork facility support a neutral effect finding for the program on the listed population.

18.2.4 North Fork Toutle Winter Steelhead Population

18.2.4.1 North Toutle Summer Steelhead Program

18.2.4.1.1 Broodstock History. Summer steelhead for this program are from the Skamania Hatchery and are not part of the LCR steelhead ESU.

18.2.4.1.2 Similarity between Hatchery-origin and Natural-origin Fish. Summer steelhead are not native to the North Fork Toutle River basin. The program goal is to manage the summer steelhead as an isolated population for harvest.

18.2.4.1.3 Program Design. The program goal is to provide fisheries for summer steelhead in the North Fork Toutle River as mitigation for hydro-system development and habitat loss. Currently 25,000 summer steelhead smolts are transferred from the Skamania Hatchery and acclimated prior to release at the North Toutle Hatchery on the Green River. Fish are released from mid-April to mid-May at 5 fish/lb. Skamania stock summer steelhead are used in this program because of the accelerated spawn timing for this stock. The goal is to temporally separate naturally spawning hatchery summer steelhead from the later spawning reference population. As with all Skamania stock summer steelhead programs, of primary concern are interactions between the reference population juveniles, and juveniles produced from naturally spawning summer steelhead. Increased monitoring of naturally spawning summer steelhead is recommended. Removal or spatial separation of returning hatchery summer steelhead from the natural-origin late winter steelhead should be investigated.

18.2.4.1.4 Program Performance. Stray rates and smolt-to-adult survival rates have not been determined for summer steelhead from this program. The harvest of summer steelhead in the Green and North Fork Toutle rivers averaged over 460 for the years 1999 to 2001 (WDFW Harvest Summaries). The average annual return to the North Toutle Hatchery was 68 summer steelhead from 1998 to 2002. Currently the North Fork is managed for natural production of winter steelhead, and the contribution of hatchery steelhead to natural spawning is near zero for the North Fork Toutle River and 17 percent in the Green River for the period 1991 to 1996 (McElhany et al. 2003). Some of these fish could have been early winter steelhead that were released into the basin during that time period. It is unknown if those naturally spawning hatchery steelhead originated from this program. This program is funded through the Mitchell Act, and future funding of this program is uncertain.

18.2.4.1.5 VSP Effects. The net effect of this program would be considered neutral, unless program fish successfully spawn and produce juveniles that interact with the late winter steelhead populations. The fact that low numbers of unmarked summer steelhead are observed at the North Toutle Hatchery supports the conclusion that the program has a neutral effect on the listed population.

18.2.5 Kalama River Winter Steelhead Population

18.2.5.1 Kalama River Wild Winter Steelhead Program

18.2.5.1.1 Broodstock History. Adults for this program are derived from natural-origin winter steelhead returning to the Kalama Falls Fishway Trap.

18.2.5.1.2 Similarity between Hatchery-origin and Natural-origin Fish. This program was initiated in 1998 using only natural-origin (unmarked) winter steelhead, so they should be similar to the natural-origin winter steelhead. However, program fish are released as one-year smolts, where natural-origin juveniles emigrate generally as two-year smolts.

18.2.5.1.3 Program Design. The program goals are to provide harvest of winter steelhead in Kalama River and mainstem Columbia River fisheries and to conserve/enhance the natural-

origin population of winter steelhead in the Kalama River. This is an integrated program, and the annual production goal is to release 45,000 smolts that are 100-percent adipose fin-clipped; and with a CWT. These fish are not part of the pedigree study but are marked for evaluation of survival and contribution to fisheries. The program fish are acclimated at the Gobar Pond and then released. Returning hatchery-origin winter steelhead adults from this program are released upstream in proportion to the natural-origin adults that are used for broodstock. Surplus program winter steelhead escaping to the trap are recycled downstream into the recreational fishery. After mid-February, hatchery origin adults are extracted from the system and are either provided to food banks or released into landlocked lakes for additional fishing opportunities. The program fish are being used to evaluate release strategies and residualism. The Kalama Falls Fishway trap allows for evaluation of returning adults and separation of hatchery-origin and natural-origin adults. The trap provides for control of the proportions of natural-origin and hatchery-origin adults that contribute to the spawning population upstream of the trap. Natural spawning of program fish does occur below the falls and is monitored during annual spawning ground surveys.

18.2.5.1.4 Program Performance. This is a relatively new program, and it is too early to evaluate if harvest goals are being achieved. Stray rates for this program have not been determined. In 2001-02, 964 adults returned to the Kalama Falls Fishway trap; in 2002-03, 660 adults returned; and in 2003-04, the preliminary return is 497 (WDFW Hatchery Return Data). The number of program fish that are spawning downstream of the Kalama Falls Fishway is unknown. This program is funded through the Mitchell Act, and future funding of this program is uncertain, though the research that is being conducted at this facility is considered very important to the evaluation of hatchery-origin winter steelhead supplementation of natural-origin production. The dam at Kalama Falls was damaged by high flows in 2003 and is not a complete barrier to upstream passage. The breach has impacted the ability to sort and control the proportions of hatchery-origin and natural-origin winter steelhead above the falls. The fishway trap is also in need of upgrading to improve handling and sorting of steelhead, chinook, and coho.

18.2.5.1.5 VSP Effects. Overall, this program has provided a slight benefit to the reference population. This program has not substantially increased the number of natural spawners, because hatchery-origin program fish are released upstream into the natural spawning population in proportion to the number of natural-origin winter steelhead collected for broodstock. The program may increase natural spawning below the falls and potentially reduce impacts to diversity by replacing releases of non-ESU winter steelhead .

18.2.5.2 Kalama Winter Steelhead Program

18.2.5.2.1 Broodstock History. This program uses locally adapted early winter steelhead that return to the Kalama Falls Fishway trap. Broodstock for this program were derived from Elochoman River Hatchery winter steelhead stock, though Lewis River early winter stock can also be used if there is a shortfall in returns.

18.2.5.2.2 Similarity between Hatchery-origin and Natural-origin Fish. This is an isolated program and the hatchery winter steelhead are segregated from the natural-origin winter steelhead.

18.2.5.2.3 Program Design. Broodstock is collected from early winter steelhead returns to the Kalama Falls Fishway trap. Only marked (adipose fin-clipped) winter steelhead are used for broodstock. The production goal is an annual release of 45,000 smolts. Program fish are 100-percent marked and tagged with an adipose fin clip and CWT combinations. Fish are reared at Kalama Falls Hatchery and acclimated in Gobar Pond along with steelhead from the wild summer steelhead and wild winter steelhead programs. Early winter steelhead from this program are not released upstream of the trap, and those that are surplus to broodstock needs are recycled downstream into the recreational fisheries. In February, returning early winter steelhead are either provided to a food bank or placed in a landlocked lake. This is an important stock that is being used to compare survival and contribution to fisheries with the wild winter steelhead program fish. It has been identified that better coordination is needed among lower Columbia River basins regarding the marking and tagging of different release groups.

18.2.5.2.4 Program Performance. Stray rates for program fish have not been identified. Adult early winter steelhead escapement to the trap has ranged from a recent low of 104 in 1999 to a high of 2,701 in 2002 (WDFW Hatchery Return Data). The harvest of winter steelhead averaged almost 1,150 for the 1999-00 to 2001-02 return years (WDFW Harvest Summaries). Prior to about 1997, hatchery-origin winter steelhead accounted for up to 50 percent of the natural spawning population, but since that time, all hatchery-origin early winter steelhead are removed from the spawning population above Kalama Falls. There is little genetic evidence for introgression of program fish into the natural-origin winter steelhead population (McElhany *et al.* 2003). There is still the potential for those fish that are not collected at the trap to spawn naturally below the falls. This program is funded through the Mitchell Act, and future funding of this program is uncertain. The dam at Kalama Falls was damaged by high flows in 2003 and is not a complete barrier to upstream passage. The breach has impacted the ability to sort and control the proportions of hatchery-origin and natural-origin winter steelhead above the falls. The fishway trap is also in need of upgrading to improve handling and sorting of steelhead, chinook, and coho.

18.2.5.2.5 VSP Effects. The net effect of this program is neutral unless program fish successfully spawn below the trap in high enough numbers that adult progeny of hatchery-origin winter steelhead could be passed upstream. Removal of hatchery-origin program winter steelhead at the trap minimizes impacts to the natural adult steelhead population.

18.2.6 North Fork Lewis River Winter Steelhead Population

18.2.6.1 Merwin Winter Steelhead Program

18.2.6.1.1 Broodstock History. Broodstock is collected at the Lewis River Hatchery and the Merwin Trap. Broodstock was derived from Beaver Creek Hatchery and Skamania Hatchery winter steelhead stocks, but Cowlitz Hatchery and Chambers Creek stocks have also been released into the basin.

18.2.6.1.2 Similarity between Hatchery-origin and Natural-origin Fish. This is an isolated program, and the hatchery winter steelhead are segregated from the natural-origin winter steelhead.

18.2.6.1.3 Program Design. This is a mitigation program for fisheries in the Lewis and lower Columbia rivers that were adversely impacted by the loss of habitat in the N.F. Lewis River due to dam construction. The production goal for this program is an annual release of 100,000 smolts. Broodstock collection starts December 10, and spawning must be completed by January 31. Smolts volitionally emigrate into a smolt pond and are then transported down to Rkm 8.1 (Island Boat Launch) for release from April 15 to May 1. All production is 100-percent adipose fin-clipped to allow for selective fisheries. There is the potential to use the late winter steelhead returning to the Cedar River as a source for the development of a local broodstock to replace the current program.

18.2.6.1.4 Program Performance. Stray rates of program fish into other basins are unknown. Hatchery returns have averaged 2,034 from 2000-2002, with a return of 4,927 in 2002. An estimated 2,078 returned in 2003 (WDFW Hatchery Return Data). The harvest of winter steelhead in the N.F and lower mainstem Lewis River averaged 1,250 from 2000 to 2002 (WDFW Harvest Summaries). It is estimated that only 6 percent of the naturally spawning population in the lower Lewis River are natural-origin winter steelhead (McElhany *et al.* 2003). Dam construction eliminated access to 80 percent of the historical winter steelhead habitat, and current winter steelhead habitat is limited to Cedar Creek and Fossil Creek. Very little natural production occurs in the lower river. This program is funded by Pacificorp to mitigate for lost natural fish production and continued funding is expected into the future. The hydro-projects on the Lewis are currently under review for relicensing, and this process is expected to result in changes to this program.

18.2.6.1.5 VSP Effects. This program probably has a negative effect on the reference population due to the introgression of hatchery steelhead on the spawning grounds. This effect may be ameliorated by the temporal separation in spawning time observed for the program fish and the reference natural population.

18.2.7 East Fork Lewis River Winter Steelhead Population

18.2.7.1 E.F. Lewis Winter Steelhead Program

18.2.7.1.1 Broodstock History. Early winter steelhead that are released from this program have originated from a number of sources, including Beaver Creek Hatchery, Elochoman Hatchery, Merwin Hatchery, and, in recent years, Skamania Hatchery.

18.2.7.1.2 Similarity between Hatchery-origin and Natural-origin Fish. This is an isolated program and the hatchery winter steelhead are segregated from the natural-origin winter steelhead.

18.2.7.1.3 Program Design. The program goal is to provide fisheries for winter steelhead in the E.F. Lewis River as mitigation for hydro-system development and habitat loss. The production goal for the program is an annual release of 80,000 smolts that are 100-percent adipose fin-clipped to allow for selective harvest. Fish are transported from Skamania Hatchery or Merwin Hatchery and directly stream-released at Rkm 6.4 and 8.1 on the E.F. Lewis River. There is no way to control hatchery-origin and natural-origin winter steelhead adult escapement in the basin, but the lower river release locations are spatially separated from natural-origin population spawning and rearing areas.

18.2.7.1.4 Program Performance. Stray rates and smolt-to-adult survival rates for program winter steelhead have not been estimated. Harvest of winter steelhead has averaged almost 1,175 from 2000 to 2002. In 2002, the E.F. Lewis was one of the top ten winter steelhead harvests with a total catch of 2,169 winter steelhead (WDFW Harvest Summaries). The large returns of adult early winter steelhead have not introgressed with the natural population, even though in some years, up to 51 percent of total number of steelhead spawning naturally in the river are hatchery-origin winter steelhead (McElhany et al. 2003). Genetic data show that naturally produced E.F. Lewis River winter steelhead continue to be distinct from the hatchery populations. This may be due to the later spawn timing on natural steelhead, which provides a level of reproductive isolation. This program is funded through the Mitchell Act, and future funding is uncertain.

18.2.7.1.5 VSP Effects. The net effect of this program is probably neutral because of the spatial and temporal separation between the program winter steelhead adult returns and the reference population. Genetic evidence shows that the naturally produced population remains distinct from the hatchery winter steelhead.

18.2.8 Salmon Creek Winter Steelhead Population

18.2.8.1 Kline Ponds Winter Steelhead Program

18.2.8.1.1 Broodstock History. Program winter steelhead are from Skamania Hatchery.

18.2.8.1.2 Similarity between Hatchery-origin and Natural-origin Fish. This is an isolated program, and the hatchery winter steelhead are segregated from the natural-origin winter steelhead.

18.2.8.1.3 Program Design. The program goal is to provide fisheries for winter steelhead in Salmon Creek as mitigation for hydro-system development and habitat loss. Hatchery winter steelhead from Skamania Hatchery are transferred to net pens in Kline Pond on Salmon Creek for acclimation and release. The production goal is for a release of 20,000 smolts annually that are 100-percent adipose fin-clipped to allow for selective harvest. The status of the natural population of winter steelhead in Salmon Creek is unknown. It has been proposed that a trap be constructed at a barrier below the Highway 99 overpass to monitor winter steelhead and coho salmon returning to the basin. Funding is needed for this facility and future monitoring. If the trapping facility is constructed and the naturally produced population is large enough, a locally adapted broodstock program could be developed, and the non-ESU winter steelhead program could be eliminated.

18.2.8.1.4 Program Performance. Stray rates and smolt-to-adult survival have not been estimated for this program. The harvest of winter steelhead has averaged over 340 for the 2000-02 period, with big catches of over 450 in 2000 and 2002 (WDFW Harvest Summaries). This program is funded through the Mitchell Act, and future funding of this program is uncertain.

18.2.8.1.5 VSP Effects. The net effect of this program is probably negative, because the program steelhead can interbreed with naturally produced winter steelhead in the basin. The status of the naturally spawning population is unknown.

18.2.9 Washougal River Winter Steelhead Population

18.2.9.1 Skamania Winter Steelhead Program

18.2.9.1.1 Broodstock History. The broodstock was derived from Chambers Creek and Beaver Creek stocks of early winter steelhead. Current production uses returns to the Skamania Hatchery.

18.2.9.1.2 Similarity between Hatchery-origin and Natural-origin Fish. This is an isolated program, and the hatchery winter steelhead are segregated from the natural-origin winter steelhead.

18.2.9.1.3 Program Design. The program goal is to provide fisheries for winter steelhead in the Washougal River as mitigation for hydro-system development and habitat loss. The current production goal is an annual release of 60,000 adipose fin-clipped smolts into the Washougal River. Half of the production is released at the hatchery, and the other half is released at Rkm 12.9. This is a reduction from past releases of over 100,000 smolts. Winter steelhead from this hatchery are also used to augment fisheries in other basins (see programs described above). Hatchery fish are collected at the Skamania Hatchery, but there is some concern that hatchery returns stop short and do not recruit to the hatchery. An alternative to use of this stock of early winter steelhead would be use of the native winter steelhead to develop a broodstock for the program.

18.2.9.1.4 Program Performance. Stray rates and smolt-to-adult survival rates have not been estimated for this program. The program supports a popular recreational fishery in the basin, with an average harvest of 670 for the 2000-2002 return years (WDFW Harvest Summaries). Returns have ranged from 394 in 2002 to over 1,000 in 2001 (WDFW Hatchery Return Data). Interbreeding is thought to be very low because of differences in run timing between early winter hatchery steelhead and the reference population (McElhany *et al.* 2003). This program is funded through the Mitchell Act, and future funding of this program is uncertain.

18.2.9.1.5 VSP Effects. The net effect of the program on the reference population is probably negative because of the potential for interbreeding between program winter steelhead and the reference population.

18.2.10 Clackamas River Winter Steelhead Population

18.2.10.1 Clackamas River Late Winter Steelhead Program

18.2.10.1.1 Broodstock History. Broodstock was collected from unmarked natural-origin late winter steelhead trapped at North Fork Dam fish ladder on the Clackamas River from 1991 to 1997. Since 1998, hatchery broodstock has consisted of 70 percent program fish and 30 percent natural-origin fish. This program replaced releases of Big Creek early winter steelhead (which were last released in 2001) in the upper basin and Eagle Creek NFH winter steelhead releases at the Clackamas Hatchery.

18.2.10.1.2 Similarity between Hatchery-origin and Natural-origin Fish. Broodstock is collected from unmarked winter steelhead trapped at the North Fork Dam fish ladder. The program winter steelhead differ from the natural-origin population that tends to emigrate as two-year smolts, whereas program fish are released as one-year smolts.

18.2.10.1.3 Program Design. The program is designed to provide adult steelhead for harvest in the Clackamas River as mitigation for impacts from dam construction and operation and habitat loss in the Clackamas River basin and the Columbia River. The production goal is an annual release of 165,000 smolts (120,000 on-station at the Clackamas Hatchery (Rkm 37) and 45,000 at the Cassidy Pond (Rkm 12.8)). Broodstock is collected at the North Fork Dam fish ladder, taking no more than 25 percent of the natural-origin returns. Program fish are spawned at the Clackamas Hatchery and eyed eggs are sent to the Irrigon Hatchery for rearing to smolt size. Fingerlings at 200 fish/lb, are sent to Oak Springs Hatchery for rearing to smolt size. These fish are transported back as presmolts for acclimation at the Cassidy Pond. Cold water temperatures at the Clackamas hatchery prevents the rearing of one-year smolts.

18.2.10.1.4 Program Performance. Stray rates and smolt-to-adult survival rates have not been estimated for this program. The program has released fish since 1992 but has not met production goals until 2001. Returns of program winter steelhead to the North Fork Dam fish ladder has averaged over 1,000 fish since 2000. The harvest of winter steelhead in the Clackamas River averaged almost 1,500 adults annually from 1991-92 to 1995-96 (Clackamas Late Winter Steelhead HGMP 2002). The program is funded through the Mitchell Act (29.6 percent), the State of Oregon General Fund (29.6 percent), Portland General Electric (22 percent) and the City of Portland (18.8 percent). Mitchell Act funding is uncertain, and Portland General Electric's share is expected to change as a result of relicensing negotiations.

18.2.10.1.5 VSP Effects. The program has probably had a net beneficial effects on VSP parameters for the natural population by increasing the number of naturally spawning winter steelhead in the lower Clackamas River and by replacing non-ESU Big Creek winter steelhead with production that is locally adapted. The proportion of hatchery-origin late winter steelhead above the North Fork Dam is controlled at a trap on the fish ladder. Currently the area above the dam (80 percent of the winter steelhead habitat) is managed as a wild fish refuge, and no hatchery fish are passed upstream. The program has the potential to supplement the natural-origin population if escapement declines.

18.2.10.2 Eagle Creek NFH Winter Steelhead Program

18.2.10.2.1 Broodstock History. Returns to Eagle Creek NFH are used for production of winter steelhead. The winter steelhead stock is a combination of Big Creek and native Clackamas River stocks.

18.2.10.2.2 Similarity between Hatchery-origin and Natural-origin Fish. This is an isolated program, and the hatchery winter steelhead are segregated from the natural-origin winter steelhead.

18.2.10.2.3 Program Design. The program goal is to provide fisheries for winter steelhead in the Clackamas River as mitigation for hydro-system development and habitat loss. The annual production goal is a release of 150,000 smolts from the Eagle Creek NFH on Eagle Creek (tributary to lower Clackamas River). This is a reduction from the past production goal of 200,000 smolts. All production is externally marked with an adipose and right ventral fin-clip to allow for selective fisheries and identification at the Clackamas Hatchery and the North Fork Dam fish ladder.

18.2.10.2.4 Program Performance. The stray rate of program winter steelhead in other parts of the basin has not been determined. The average smolt-to-adult survival rate was 0.46 percent for the 1987 to 1999 broodyears. The program goal is a smolt-to-adult survival rate of 0.33 percent. The program fish provide for a substantial harvest. It was estimated that, for every steelhead returning to the Eagle Creek Hatchery, 1.86 were harvested in Eagle Creek, and when the entire Clackamas River subbasin is included, the ratio increases to 1:2.7 (Eagle Creek NFH Steelhead HGMP 2002). Annual returns to the hatchery have averaged 805 adults and ranged from 251 to 3,671 from 1980 to 2002. The program is funded through the Mitchell Act, and future funding of this program is uncertain.

18.2.10.2.5 VSP Effects. The net effect of this program on the reference population is neutral. The program hatchery-origin winter steelhead are temporally and spatially segregated from the natural-origin late winter steelhead.

18.2.10.3 Clackamas Summer Steelhead Program

18.2.10.3.1 Broodstock History. Broodstock for this program is from the South Santiam Hatchery. South Santiam summer steelhead were derived from Skamania stock summer steelhead.

18.2.10.3.2 Similarity between Hatchery-origin and Natural-origin Fish. This is an isolated program, and the hatchery summer steelhead are segregated from the natural-origin winter steelhead.

18.2.10.3.3 Program Design. The program is designed to provide harvest augmentation in the Clackamas River as mitigation for impacts from dam construction and operation and habitat loss in the Clackamas River basin and the Columbia River. The program goal is for an annual release of 175,000 smolts. All production is adipose fin-clipped to allow for selective fisheries and

removal at the North Fork Dam fish ladder. Broodstock is collected and spawned at the South Santiam Hatchery, and eyed eggs are sent to the Bonneville Hatchery for incubation and rear to presmolts. Final rearing and acclimation occurs at the Clackamas Hatchery. As with all Skamania stock summer steelhead programs, a primary concern is the interaction between the reference population juveniles and juveniles produced from naturally spawning summer steelhead. All marked and unmarked summer steelhead are trapped and prevented from passing above the North Fork Dam. Summer steelhead are either recycled to the lower Clackamas River or are released into Faraday Lake.

18.2.10.3.4 Program Performance. Stray rates and smolt-to-adult survival rates have not been determined for this program. Since 2001, all hatchery-origin and natural-origin summer steelhead were prevented from passing above the North Fork Dam. Summer steelhead are not native to the Clackamas basin, and there was concern that summer steelhead would compete with the listed late winter steelhead. Summer steelhead returns to the North Fork Dam trap averaged over 2,200 from 2001 to 2003. The harvest management goal for the Clackamas River is a harvest of 7,000 summer steelhead annually. The Clackamas Hatchery is funded through the Mitchell Act (29.6 percent), the State of Oregon General Fund (29.6 percent), Portland General Electric (22 percent) and the City of Portland (18.8 percent). The South Santiam Hatchery is funded by the U.S. Army Corps of Engineers (Corps), and the Bonneville Hatchery is funded through the Mitchell Act (55 percent) and the Corps (45 percent) (APRE reports). The funding from the Mitchell Act is uncertain, and the obligations of Portland General Electric and the City of Portland are expected to change as a result of hydro-project relicensing negotiations.

18.2.10.3.5 VSP Effects. The net effect of the program is neutral, because program fish are prevented from spawning above the North Fork Dam, and they are temporally separated from the reference population.

18.2.11 Sandy River Winter Steelhead Population

18.2.11.1 Sandy River Late Winter Steelhead Program

18.2.11.1.1 Broodstock History. Broodstock is collected at Marmot Dam from unmarked late winter steelhead returning to the upper basin. In the past, Big Creek stock winter steelhead was released into the basin.

18.2.11.1.2 Similarity between Hatchery-origin and Natural-origin Fish. The program winter steelhead are derived from unmarked late winter steelhead and should be considered similar. The program has two release strategies, with part of the release being one-year smolts and the rest being two-year smolts.

18.2.11.1.3 Program Design. The program is designed to provide recreational harvest opportunities on hatchery winter steelhead while minimizing intentional risks to naturally producing populations as mitigation for hydro-system construction and operation and loss of habitat in the basin. Broodstock is collected at Marmot Dam and spawned and incubated to eyed eggs in the Sandy Hatchery. Eyed eggs are shipped to Oxbow Hatchery (160,000) and Irrigon Hatchery (115,000). At the Oxbow Hatchery, the fish are reared to ~ 70 fish/lb. and are then

transferred to Bonneville Hatchery for rearing. When they become two-year smolts, they are transferred to Sandy Hatchery for a three-week acclimation and are subsequently released. At the Irrigon Hatchery, the eyed eggs are incubated and reared to one-year smolts. The one-year smolts are then transferred to the Sandy Hatchery for a three-week acclimation and are subsequently released. Final production goals are for releases of 100,000 one-year smolts and 60,000 two-year smolts annually. All production is 100-percent adipose fin-clipped to allow for selective fisheries. The Sandy River program was transitioned into an integrated program, because Marmot Dam, where sorting occurs, will be removed in the near future, preventing the sorting of program and natural fish. Natural spawning of program fish will be monitored, to indentify, and limit the proportion of program fish on the spawning grounds.

18.2.11.1.4 Program Performance. This program started with release of one-year smolts in 1997. Releases were less than 60,000 smolts until 2001, when the production goal of 160,000 smolts was achieved. The number of natural-origin winter steelhead at Marmot Dam has averaged 775 adults from 1999 to 2003. The Sandy River basin is a popular recreational fishing area close to the Portland metropolitan area. The winter steelhead harvest has averaged almost 2,250 adults from 1992-93 to 1996-97 seasons (Sandy Late Winter Steelhead HGMP 2002). Program returns have not yet been estimated.

18.2.11.1.5 VSP Effects. The net effect of the program is considered neutral, as almost all program fish return to the hatchery release location, away from the primary spawning areas of the reference population. The program can provide a benefit by acting as a resource to supplement the natural-origin population if escapement declines. The program has not increased the number of natural spawners above Marmot Dam, because hatchery winter steelhead are removed there, but it may have increased the number of fish in the lower river.

18.2.11.2 Sandy River Summer Steelhead Program

18.2.11.2.1 Broodstock History. Broodstock for this program is from the South Santiam Hatchery. South Santiam summer steelhead were derived from Skamania stock summer steelhead.

18.2.11.2.2 Similarity between Hatchery-origin and Natural-origin Fish. This is an isolated program, and the hatchery summer steelhead are segregated from the natural-origin winter steelhead.

18.2.11.2.3 Program Design. The program goal is to provide fisheries for summer steelhead in the Sandy River as mitigation for hydro-system development and habitat loss. The program goal is for an annual release of 40,000 smolts from the Bonneville Hatchery and 35,000 smolts from the Oak Springs Hatchery. All of the production is adipose fin-clipped to allow for selective fisheries. Broodstock is collected and spawned at the South Santiam Hatchery, and eyed eggs are transferred to the Bonneville Hatchery and Oak Springs Hatchery for incubation and early rearing. The final three to four weeks of acclimation is at the Sandy Hatchery. All marked summer steelhead that are trapped at Marmot Dam are returned to the hatchery or recycled downstream to allow for more fishing opportunities. As with all Skamania stock summer steelhead programs, a primary concern is the interactions between the reference population

juveniles and juveniles produced from naturally spawning summer steelhead. Only unmarked steelhead are passed above the dam. In 1999, the program transitioned from outplanting summer steelhead in the upper Sandy River basin above Marmot Dam to releasing the summer steelhead at the Sandy Hatchery, below Marmot Dam. Adults collected at the dam are either transported downstream or placed into a landlocked lake to support recreational fisheries. An evaluation is currently being conducted to determine the number of hatchery-origin summer steelhead that could potentially stray above the dam after its removal in 2007. If the summer steelhead remain isolated at the area around the hatchery, then this program might be continued after dam removal.

18.2.11.2.4 Program Performance. Stray rates and smolt-to-adult survival rates estimates have not been determined for this program. Since 1999, when all marked hatchery steelhead were prevented from passing above Marmot Dam, the number of marked summer steelhead has averaged 250 annually. However, marked summer steelhead collected at the dam have shown a declining trend, with only 71 adults handled in 2002 and 29 adults in 2003. This trend probably reflects the change in release location. The program is funded by ODFW, the Corps, and through the Mitchell Act. Mitchell Act funding of this program into the future is uncertain.

18.2.11.2.5 VSP Effects. The net effect of the program is probably neutral, because program summer steelhead are removed at Marmot Dam and have been confined to the lower river in the vicinity of the Sandy Hatchery.

18.2.12 Hood River Winter Steelhead Population

18.2.12.1 Hood River Winter Steelhead Program

18.2.12.1.1 Broodstock History. The broodstock for this program is from natural-origin winter steelhead returning to the trap at Powerdale Dam (Rkm 6.4). Big Creek winter steelhead were last released into the basin in 1993, and since then, only program fish and unmarked natural-origin winter steelhead have been passed above the dam.

18.2.12.1.2 Similarity between Hatchery-origin and Natural-origin Fish. The goal is to maintain the program winter steelhead and the natural-origin steelhead as one population. The only difference is that the program fish are released as one-year smolts, whereas the natural-origin winter steelhead tend to emigrate as two-year smolts.

18.2.12.1.3 Program Design. The program is designed to supplement the naturally spawning population of winter steelhead in the Hood River and support Tribal and recreational fisheries in the Hood River. The program is part of an evaluation to determine the relative reproductive success of hatchery-origin and natural-origin winter steelhead allowed to spawn naturally in the Hood River. Broodstock is collected from unmarked adults trapped and sampled at Powerdale Dam. At a minimum, 75 percent of the natural-origin adults are passed upstream to spawn naturally. No more than 50 percent of the natural spawning population above the dam can be hatchery-origin winter steelhead. Broodstock is transported and held to spawning at the Roger Springs facility in the Hood River basin. Eggs are incubated to juveniles at Oak Springs Hatchery on the Deschutes River. There are two acclimation sites for the winter steelhead

program, the East Fork Irrigation and the Parkdale Fish facilities. The production goal is an annual release of 60,000 smolts split between the two locations. Smolts are volitionally released, and all non-migrants are trucked downstream and released below the dam. All releases are externally marked to allow for harvest and separation at Powerdale Dam.

18.2.12.1.4 Program Performance. Stray rates have not been determined for the program. The average smolt-to-adult survival rate based on fish returning to Powerdale Dam was 1.41 percent, ranging from 0.29 to 2.89 percent (1992 to 1998 broodyears). The average number of program adults returning to the dam was 454 adults from 1995 to 2000. For the same time period, the average number of winter steelhead harvested in the Hood River was 264 adults. The natural-origin escapement was 492 adults. There is a concern with the practice of recycling surplus hatchery returns into the lower river to provide for additional harvest opportunities. An evaluation of harvest and returns has observed that an average of 89 percent of the recycled winter steelhead go unaccounted for (HRPPR 2003). This is a major concern and has been identified as a focus of future monitoring activities. The program is funded by BPA and is part of the Hood River Production Program. The program has recently gone through a review and will up for continued funding under the Fish and Wildlife Program.

18.2.12.1.5 VSP Effects. The program has had a net beneficial effect by increasing the abundance of the reference population. The program is also part of research project using the pedigree of returning adults to determine the relative reproductive success of hatchery-origin and natural-origin winter steelhead. The program controls the number of hatchery-origin spawners in the spawning population above the dam by trapping and removal.

18.2.13 Kalama River Summer Steelhead Population

18.2.13.1 Kalama River Wild Summer Steelhead Program

18.2.13.1.1 Broodstock History. Adults for this program are derived from natural-origin summer steelhead returning to the Kalama Falls Fishway Trap.

18.2.13.1.2 Similarity between Hatchery-origin and Natural-origin Fish. This program was initiated in 1998 using only natural-origin (unmarked) summer steelhead, so they should be similar. However, program fish are released as one-year smolts, whereas natural-origin juveniles emigrate generally as two-year smolts.

18.2.13.1.3 Program Design. The program goals are to provide harvest of summer steelhead in Kalama River and mainstem Columbia River fisheries and to conserve/enhance the natural-origin population of summer steelhead in the Kalama River. This is an integrated program, and the production goal is to release 60,000 smolts that are 100-percent adipose fin-clipped with a CWT in the cheek. The program fish are reared at Fallert Creek to use warmer water for incubation and initial rearing. Final rearing occurs at the Kalama Falls Hatchery. This is part of a research project looking at the pedigree of returning adults to assess the relative reproductive success of hatchery-origin returns and natural-origin returns allowed to spawn naturally above Kalama Falls. Hatchery-origin summer steelhead are released above the trap in proportion to the natural-origin summer steelhead that are taken into the broodstock. Surplus program summer

steelhead are recycled downstream into the fisheries. After mid-February, hatchery-origin summer steelhead are extracted from the system and are either provided to a food bank or released into landlocked lakes to provide additional harvest opportunities.

18.2.13.1.4 Program Performance. Stray rates have not been determined for this program. Harvest of summer steelhead in the Kalama River averaged almost 1,100 adults from 1999-2001 (note that this also includes summer steelhead from the Skamania stock program)(WDFW Harvest Summaries). This program is funded through the Mitchell Act, and future funding of this program is uncertain, though the research that is being conducted at this facility is considered very important to the evaluation of hatchery-origin winter steelhead supplementing natural-origin production. The dam at Kalama Falls was damaged by high flows in 2003 and is not a complete barrier to upstream passage. The breach has impacted the ability to sort and control the proportions of hatchery-origin and natural-origin winter steelhead above the falls. The fishway trap is also in need of upgrading to improve handling and sorting of steelhead, chinook, and coho. By the end of March 2004, about 528 natural-origin summer steelhead and 464 hatchery-origin adults had been passed upstream of Kalama Falls Hatchery. In addition, an estimated 192 wild, 142 Kalama hatchery (wild broodstock), and 693 non-local hatchery (Skamania stock) adults passed upstream unsampled via a partial breach in the falls barrier. Those estimates were based on expansion of the numbers of adults observed during a September snorkel survey. The 1999 brood return rate of 3.7 percent last year (2615/69,939) is still about double the return rate of 1.8 percent for this year (2000 brood) (700/39,274), even though the latter is inflated by the fact that it includes 3-salts (fish that spend three years in the ocean) from the 1999 brood (Kalama Research update 2004) .

18.2.13.1.5 VSP Effects. The program has a beneficial effect by increasing the abundance of the reference population. The program does not necessarily increase the number of spawners, because program fish are released upstream to spawn in proportion to the number of natural-origin summer steelhead used for broodstock. This proportion is being affected by the breach in the weir, which allows unsampled passage of summer steelhead. The ESU as a whole is expected to benefit from the research that is being conducted as part of this program, because it addresses a key question regarding the productivity of hatchery-origin summer steelhead that are allowed to spawn naturally.

18.2.13.2 Kalama Summer Steelhead Program

18.2.13.2.1 Broodstock History. Broodstock is from the Merwin Hatchery and is derived from Skamania stock summer steelhead. Skamania Hatchery summer steelhead are also used for this program.

18.2.13.2.2 Similarity between Hatchery-origin and Natural-origin Fish. This is an isolated program, and the hatchery summer steelhead are segregated from the natural-origin summer steelhead.

18.2.13.2.3 Program Design. The program goal is to provide fisheries for summer steelhead in Kalama River as mitigation for hydro-system development and habitat loss. The production goal is an annual release of 30,000 adipose fin-clipped smolts acclimated and released at the Fallert

Creek facility in the lower Kalama River. Hatchery summer steelhead are removed at the Kalama Fall Fishway trap and recycled downstream into the fisheries. The program fish are not passed above the trap. There is a concern with the recycling of hatchery-origin steelhead and the potential to stray. Marking and monitoring of program fish so the level of straying could be determined should be considered. There is the potential to shift current production to Kalama River summer steelhead, but current facilities in the Kalama River could not produce a one-year smolt without modifications to the facilities. As with all Skamania stock summer steelhead programs, a primary concern is the interaction between hatchery and natural steelhead juveniles.

18.2.13.2.4 Program Performance. Stray rates and smolt-to-adult survival rates have not been estimated for this program. There is some evidence that a high number of program summer steelhead stray into the Lewis River. This may be due to a “cool” water attraction. Harvest of summer steelhead in the Kalama River averaged almost 1,100 from 1999-2001 (note that this also includes summer steelhead from the wild summer steelhead program)(WDFW Harvest Summaries). Returns to the hatchery trap have averaged more than 1,260 in recent years (WDFW Hatchery Return Data). The McElhany et al. (2003) identified that, even with the large portion of non-ESU hatchery fish being released in the basin, the reference population remains genetically distinct from the Skamania stock summer steelhead. Differences in spawn timing and overall fitness between the two summer steelhead stocks may have reduced the potential for introgression. This program is funded through the Mitchell Act, and future funding of this program is uncertain

18.2.13.2.5 VSP Effects. The net effect of this program on the reference population is neutral. Program fish are removed from the population above Kalama Falls, and the fitness of any naturally spawning summer steelhead below the falls is poor.

18.2.14 North Fork Lewis River Summer Steelhead Population

18.2.14.1 Merwin Summer Steelhead Program

18.2.14.1.1 Broodstock History. Broodstock is collected from returns to the Merwin Trap and Lewis River Hatchery. The summer steelhead broodstock is a derivative of Skamania Stock summer steelhead that have been released into the N.F. Lewis River.

18.2.14.1.2 Similarity between Hatchery-origin and Natural-origin Fish. This is an isolated program, and the hatchery summer steelhead are segregated from the natural-origin summer steelhead.

18.2.14.1.3 Program Design. This is a mitigation program for lost fisheries in the Lewis River and lower Columbia River and for the loss of habitat in the N.F. Lewis River due to dam construction. The production goal is an annual release of 175,000 summer steelhead smolts that are 100-percent adipose fin-clipped to allow for selective harvest. The Speelyai net pens are used to rear 60,000 smolts (see description below). Production from Merwin Hatchery and the net pens are transported and released at Rkm 8.1. It has been proposed that summer steelhead from the E.F. Lewis River be used for broodstock to replace the current Skamania stock derivative, but the status and size of the E.F. Lewis River population is unknown. During high return years, up

to 7,000-8,000 summer steelhead can be recycled. As with all Skamania stock summer steelhead programs, a primary concern is the interaction between natural and hatchery fish.

18.2.14.1.4 Program Performance. Stray rates and smolt-to-adult survival rates have not been estimated for this program. The harvest of summer steelhead in the N.F. and mainstem Lewis River averaged over 3,000 summer steelhead from 2000-2002. In 2001-2002, the N.F. Lewis was one of the top ten summer steelhead harvest streams in Washington (WDFW Harvest Summaries). The program is meeting its goal of supporting recreational fisheries. The high level of recycling is a concern, because it is unknown what happens to those summer steelhead that are not harvested and do not return to the hatchery. Monitoring efforts need to address this concern. Returns to the Merwin hatchery of unmarked summer steelhead have averaged less than 10 adults in recent years (WDFW Hatchery Return Data). When the Merwin Dam was constructed, over 80 percent of the summer steelhead spawning habitat in the N.F. Lewis River was eliminated. Native summer run fish could not migrate above Merwin Dam, and the population has declined to very low levels. There is very little if any summer steelhead habitat below Merwin Dam. Even Cedar Creek is not considered appropriate habitat. As a result, it is estimated that naturally produced summer steelhead are only 7 percent of the total escapement (McElhany *et al.* 2003). This program is funded by PacifiCorp as mitigation and is expected to continue to be funded into the future. The hydro-projects on the Lewis River are currently going through relicensing, and that process is expected to result in changes to this program.

18.2.14.1.5 VSP Effects. The net effect of the program is probably neutral, because those hatchery-origin summer steelhead that do spawn naturally are not producing returning adults, as reflected in the lower number of unmarked summer steelhead collected at the hatchery. The program could have a negative affect on the E.F. Lewis summer steelhead population if recycled summer steelhead stray into that basin.

18.2.14.2 Fish First Summer Steelhead Program

18.2.14.2.1 Broodstock History. Skamania stock summer steelhead for this program has come from Skamania Hatchery and Merwin Hatchery. The broodstock is a derivative of Skamania stock summer steelhead.

18.2.14.2.2 Similarity between Hatchery-origin and Natural-origin Fish. This is an isolated program, and the hatchery summer steelhead are segregated from the natural-origin summer steelhead.

18.2.14.2.3 Program Design. The program goal is to provide fisheries for summer steelhead in the Lewis River as mitigation for hydro-system development and habitat loss. The program production goal is to annually release 50,000 summer steelhead smolts. The smolts are acclimated in a net pen near Echo Cove on the Lewis River (Rkm 20.9). All releases are adipose and right ventral or left ventral fin-clipped to monitor harvest and straying. As with all Skamania stock summer steelhead programs, a primary concern is the interaction between the reference population juveniles and juveniles produced from naturally spawning summer steelhead.

18.2.14.2.4 Program Performance. Monitoring of harvest at the release sight and the use of ventral clips has indicated that adults remain in the area of release supporting harvest at this location. Harvest of these fish is included in the harvest data for the Merwin summer steelhead program. The program is funded through the Mitchell Act and ALEA (Aquatic Lands) funds. Continuation of this program with Mitchell Act funds is uncertain.

18.2.14.2.5 VSP Effects. The net effect of the program is probably neutral, because those hatchery-origin summer steelhead that do spawn naturally are not producing returning adults, as reflected in the lower number of unmarked summer steelhead collected at the hatchery. The program could have a negative affect on the E.F. Lewis summer steelhead population if summer steelhead stray into that basin.

18.2.14.3 Speelyai Bay Net Pen Summer Steelhead Program

18.2.14.3.1 Broodstock History. Summer steelhead for this program are from Merwin Hatchery. The broodstock for this program is derived from Skamania Stock summer steelhead.

18.2.14.3.2 Similarity between Hatchery-origin and Natural-origin Fish. This is an isolated program, and the hatchery summer steelhead are segregated from the natural-origin summer steelhead.

18.2.14.3.3 Program Design. This is a cooperative net pen project that is operated by Fish First. Six net pens located in Speelyai Bay are used for rearing 60,000 summer steelhead from November to May. Smolts are trucked to below Merwin Dam for release. All production is 100-percent adipose fin-clipped to allow for selective fisheries. As with all Skamania stock summer steelhead programs, a primary concern is the interaction between the reference population juveniles and juveniles produced from naturally spawning summer steelhead.

18.2.14.3.4 Program Performance. See Merwin Hatchery summer steelhead above, for discussion of performance.

18.2.14.3.5 VSP Effects. The net effect of the program is probably neutral, because those hatchery-origin summer steelhead that do spawn naturally are not producing returning adults, as reflected by the lower number of unmarked summer steelhead collected at the hatchery. The program could have a negative affect on the E.F. Lewis summer steelhead population if recycled summer steelhead stray into that basin.

18.2.15 East Fork Lewis River Summer Steelhead Population

18.2.15.1 E.F. Lewis Summer Steelhead Program

18.2.15.1.1 Broodstock History. Summer steelhead for this program are from the Skamania Hatchery.

18.2.15.1.2 Similarity between Hatchery-origin and Natural-origin Fish. This is an isolated program, and the hatchery summer steelhead are segregated from the natural-origin summer steelhead.

18.2.15.1.3 Program Design. The program goal is to provide fisheries for summer steelhead in the E.F. Lewis River as mitigation for hydro-system development and habitat loss. The production goal for the program is a release of 30,000 smolts that are 100-percent adipose fin-clipped to allow for selective harvest. Fish are transport from Skamania Hatchery and directly stream-released at Rkm 6.4 and 8.1 on the E.F. Lewis River. There is no way to monitor or control hatchery-origin and natural-origin summer steelhead in the basin, but the lower river release locations are spatially separated from the natural-origin spawning population. It has been proposed that natural-origin summer steelhead from the E.F. Lewis River be used to develop broodstock for this program instead of Skamania Hatchery summer steelhead. The status and abundance of the natural-origin summer steelhead has yet to be determined. As with all Skamania stock summer steelhead programs, a primary concern is the interaction between the reference population juveniles and juveniles produced from naturally spawning summer steelhead.

18.2.15.1.4 Program Performance. Stray rates and smolt-to-adult survival rates have not been estimated for this program. The harvest of summer steelhead averaged 317 adults from 2000-2002 (WDFW Harvest Summaries). Genetic analysis indicates that E.F. Lewis River summer steelhead are most similar to other endemic populations in the region and distinct from the hatchery-origin summer steelhead stocks. This is indicative of the reproductive isolation between the two groups even though there are estimates that 71 percent of the escapement was hatchery-origin summer steelhead (McElhany et al. 2003). This program is funded through the Mitchell Act, and future funding of this program is uncertain.

18.2.15.1.5 VSP Effects. The net effect of this program is probably neutral because the reference population continues to be distinct from the hatchery-origin summer steelhead. It is still unknown whether Skamania stock summer steelhead successfully spawn and produce juveniles that interact with natural-origin juveniles.

18.2.16 Washougal River Summer Steelhead Population

18.2.16.1 Skamania Summer Steelhead Program

18.2.16.1.1 Broodstock History. Broodstock for this program is from returns to the Skamania Hatchery on the West Fork of the Washougal River. Broodstock was derived from summer steelhead from the Washougal and Klickitat rivers.

18.2.16.1.2 Similarity between Hatchery-origin and Natural-origin Fish. This is an isolated program and the hatchery summer steelhead are segregated from the natural-origin summer steelhead. This is a highly domesticated hatchery population that has used returns to the hatchery for broodstock for decades.

18.2.16.1.3 Program Design. The program goal is to provide fisheries for summer steelhead in the Washougal River and other basins in the lower Columbia River as mitigation for hydro-system development and habitat loss. Broodstock is directed into the hatchery by a picket weir across the river at the hatchery. Summer steelhead are reared at both the Skamania Hatchery and at the Vancouver Hatchery. Final rearing occurs at the Skamania Hatchery for all production. The on-station release goal for the program is 60,000 smolts annually. All smolts are adipose fin-clipped to allow for selective fisheries. Smolts are transported and released at the hatchery on the West Fork or in the Washougal River at Rkm 12.9.

18.2.16.1.4 Program Performance. Stray rates and smolt-to-adult survival rates have not been estimated for this program. Returns to the Washougal River support a popular recreational fishery. The average harvest was 689 adults from 2000-2002 with a range of 168 to 1,013 (WDFW Harvest Summaries). Returns to the hatchery have averaged 460 adults for the same period. This program is funded through the Mitchell Act, and future funding of this program is uncertain. Improvements to the weir and water intake structure are needed, along with other backlogged maintenance and repairs. An estimated 87 percent of the spawning population in the West Fork were hatchery-origin summer steelhead, but only 1 percent in the mainstem Washougal River. Genetic analysis indicates that natural-origin summer steelhead are genetically distinct from the Skamania Hatchery summer steelhead and more similar to native summer steelhead from the Wind River (McElhany *et al.* 2003).

18.2.16.1.5 VSP Effects. The net effect of this program is probably negative due to the high level of hatchery-origin fish spawning naturally.

18.2.17 Hood River Summer Steelhead Population

18.2.17.1 Hood River Summer Steelhead Program

18.2.17.1.1 Broodstock History. Broodstock for this program is collected from unmarked summer steelhead trapped at Powerdale Dam on the Hood River. The broodstock may have been influenced by releases of Skamania stock summer releases that have occurred in the past.

18.2.17.1.2 Similarity between Hatchery-origin and Natural-origin Fish. The broodstock consists of natural-origin summer steelhead, but the program differs in that the releases are one-year smolts, compared to two-year smolts for the natural-origin summer steelhead.

18.2.17.1.3 Program Design. The program is designed to supplement the naturally spawning population of summer steelhead in the Hood River and support Tribal and recreational fisheries in the Hood River. The program is part of an evaluation to determine the relative reproductive success of hatchery-origin and natural-origin summer steelhead allowed to spawn naturally in the Hood River. Broodstock is collected from unmarked adults trapped and sampled at Powerdale Dam (Rkm 6.4). At a minimum, 75 percent of the natural-origin adults are passed upstream to spawn naturally. No more than 50 percent of the natural spawning population above the dam can be hatchery-origin summer steelhead. Broodstock is transported and held for spawning at the Roger Springs facility in the Hood River basin. Eggs are incubated and reared at Oak Springs Hatchery on the Deschutes River. There are two summer steelhead acclimation sites in the West

Fork Hood River. The Blackberry Creek (Dry Run Bridge) acclimation site is located on the West Fork Hood River at Rkm 13.5, and the Jones Creek site is located at Rkm 23.3. Approximately 20,000-30,000 smolts are volitionally released into the West Fork. Non-migrants are trucked and released at the mouth of Hood River. All releases are adipose fin-clipped to allow for harvest and separation at Powerdale Dam.

18.2.17.1.4 Program Performance. Unmarked summer steelhead accounted for only 16.1 percent of the summer steelhead above the dam from 1994 to 1998. Beginning in 1997, releases of Skamania stock summer steelhead in the upper basin were terminated, and all marked summer steelhead were prevented from migrating past Powerdale Dam. First returns of program summer steelhead occurred in 2000 when 7 adults returned. Escapement increased to 396 in 2001 (HRPPR 2003). Smolt-to-adult survival rates are currently not available. The program is funded by BPA and is part of the Hood River Production Program. The program has recently gone through a review and will be up for continued funding under the Fish and Wildlife Program.

18.2.17.1.5 VSP Effects. The program has had a net beneficial effect by increasing the abundance of the reference population. The program is also part of a research project using the pedigree of returning adults to determine the relative reproductive success of hatchery-origin and natural-origin summer steelhead. The program controls the number of hatchery-origin spawners in the spawning population above the dam by trapping and removal.

18.2.17.2 Hood River Summer Steelhead (Skamania stock) Program

18.2.17.2.1 Broodstock History. Program fish are from the South Santiam Hatchery stock of summer steelhead that is reared at the Oak Springs Hatchery on the Deschutes River. The South Santiam stock of summer steelhead was derived from Skamania stock summer steelhead.

18.2.17.2.2 Similarity between Hatchery-origin and Natural-origin Fish. This is an isolated program, and the hatchery summer steelhead are segregated from the natural-origin summer steelhead.

18.2.17.2.3 Program Design. This program is designed to provide for tribal and recreational fisheries in the lower Hood River and Columbia Rivers. The program goal is for an annual release of 30,000 summer steelhead into the Hood River below Powerdale Dam (Rkm 6.4). All production is marked with an adipose and ventral fin clip to allow for selective fisheries and identification at the dam. All summer steelhead from this program are prevented from passing above the dam. Returning program fish are recycled downstream into the recreational fisheries.

18.2.17.2.4 Program Performance. The stray rate for this program has not been determined. Smolt-to-adult survival of program summer steelhead that were allowed to spawn naturally from 1993 to 1997 averaged only 0.053. Returns of Skamania stock summer steelhead to Powerdale Dam averaged over 950 adults. In the evaluation of the Hood River Production Program, it was observed that a large number of recycled steelhead could not be accounted for in harvest or returns to the trap. From 1996 to 2001, an average of 71 percent of recycled summer steelhead went unaccounted for. This is an issued that needs to be evaluated (HRPPR 2003). The program is funded by BPA and is part of the Hood River Production Program. The program has recently

gone through a review and will be up for continued funding under the Fish and Wildlife Program.

18.2.17.2.5 VSP Effects. The net effect of this program is considered to be neutral, as program fish are prevented from passing into the natural spawning areas, and habitat below the dam does not support successful spawning. The only potential detrimental effect of the program is from the unaccounted for recycled summer steelhead.

18.3 CONCLUSION

Existing Status: Threatened
BRT Finding: Threatened
Recommendation: Threatened

18.3.1. ESU Overview

18.3.1.1 History of Populations

The WLC TRT tentatively identified 23 populations (17 winter run and 6 summer run) within the LCR steelhead ESU (Myers et al. 2002). Three winter steelhead populations in the Cowlitz River basin (Upper Cowlitz River, Cispus River and Tilton River) were extirpated due to the construction of Mayfield Dam. A re-introduction program for these populations was initiated in 1996.

The other winter steelhead populations in the ESU are: Lower Cowlitz River, Coweeman River, South Fork Toutle River, North Fork Toutle River, Kalama River, North Fork Lewis River, East Fork Lewis River, Salmon Creek, Washougal River, Clackamas River, Sandy River, Lower Gorge Tributaries, Upper Gorge Tributaries, and Hood River. The summer steelhead populations are: Kalama River, North Fork Lewis River, East Fork Lewis River, Washougal River, Wind River, and Hood River.

18.3.1.2 Association Between Natural Populations and Artificial Propagation

Natural populations “with minimal genetic contribution from hatchery fish”

Steelhead artificial propagation programs were historically, and are currently, in almost all of the rivers within the LCR steelhead ESU. There are currently three (of the 23 listed natural populations in this ESU) that are likely subject to little influence from hatchery fish. These populations are winter steelhead populations in the: Lower Gorge Tributaries, Upper Gorge Tributaries, and the Wind River summer steelhead population.

Natural^a populations “that are stable or increasing, are spawning in the wild, and have adequate spawning and rearing habitat”^b

There are no populations that meet the criteria.

Mixed (Integrated Programs^c)

Mixed (aggregate natural and hatchery-origin) winter steelhead populations in the ESU are: Upper Cowlitz River, Cispus River, Tilton River, Lower Cowlitz, Kalama River, Sandy River, Clackamas River, and Hood River. Mixed summer steelhead populations are in the Kalama River, and Hood River.

Hatchery (Isolated^d)

The following hatchery programs release steelhead that are not part of the ESU: Cowlitz River Summer Steelhead, Cowlitz Early Winter Steelhead, Friends of the Cowlitz Summer Steelhead, Coweeman ponds Winter Steelhead, Cowlitz Game and Anglers Summer Steelhead, North Toutle Summer Steelhead, Kalama Winter Steelhead, Merwin Winter Steelhead, E.F. Lewis Winter Steelhead, Kline Ponds Winter Steelhead, Skamania Winter Steelhead, Eagle Creek NFH Winter Steelhead, Clackamas Summer Steelhead, Sandy River Summer Steelhead, Kalama Summer Steelhead, Merwin Summer Steelhead, Fish First Summer Steelhead, Speelyai Bay Net Pen Summer Steelhead, E.F. Lewis Summer Steelhead, Skamania Summer Steelhead, and Hood River Summer Steelhead (Skamania stock).

18.3.2. Summary of ESU Viability:

18.3.2.1 Abundance. Estimated natural-origin returns and total number of natural spawners (i.e., the combination of natural-origin and hatchery-origin chinook included in the ESU) have increased since 1998 when the ESU was listed as threatened. However, average total (aggregate natural and hatchery-origin steelhead) escapements to natural spawning areas for the most recent years, though increasing, remain well below historical levels as estimated by EDT analysis. Abundance information is not available for the many populations.

^a See HLP for definition of natural, mixed and hatchery populations

^b HLP Point 3

^c Integrated programs follow practices designed to promote and protect genetic diversity and only use fish from the same local population for broodstock (both natural-origin fish, whenever possible, and hatchery-origin fish derived from the same local population and included in the ESU). Programs operated to protect genetic diversity in the absence of natural-origin fish (e.g., captive broodstock programs and the reintroduction of fish into vacant habitat) are considered “integrated”.

^d Isolated programs do not follow practices designed to promote or protect genetic diversity. Fish that are reproductively isolated are more likely to diverge genetically from natural populations included in the ESU and to be excluded themselves from the ESU.

18.3.2.2 Productivity. The BRT (2003) identified productivity as a moderate risk factor and concluded that those populations with long term data had a high extinction probability. There are no data indicating hatchery programs have increased ESU productivity. In the BRT (2003) analysis, when it was assumed that hatchery-origin adults contributed to the natural spawning population, productivity estimates for those populations still declined.

18.3.2.3 Spatial Structure. The risk to the spatial structure of the ESU has been reduced by the re-introduction program in the Cowlitz River basin (Upper Cowlitz River, Cispus River, Tilton River populations).

18.3.2.4 Diversity. The integrated propagation programs in the Cowlitz River basin, Kalama River (winter and summer), Sandy River, Clackamas River, and Hood River (winter and summer) appear to be helping to preserve steelhead stock structure. The continued release of non-ESU summer and winter steelhead into areas where natural populations are present remains a risk factor to the genetic diversity remaining within the ESU.

18.3.3 Artificial Propagation Record

18.3.3.1 Experience with Integrated Programs. The integrated programs within the ESU are relatively new, with the following programs initiated after 1996: Cowlitz late winter steelhead, Kalama River wild winter steelhead, Kalama wild summer steelhead, Sandy River late winter steelhead, and Hood River summer steelhead. The Clackamas River late winter steelhead program and the Hood River winter steelhead program were initiated in 1991.

18.3.3.2 Are Integrated Programs Self-Sustaining. All of the integrated programs are currently self-sustaining.

18.3.3.3 Certainty that Integrated Programs will Continue to Operate. The Cowlitz River basin programs (Upper Cowlitz River, Cispus River, Tilton River, Lower Cowlitz) are funded by Tacoma Power Utilities as mitigation for impacts from the construction and operation of the hydro-system on the Cowlitz River. Funding of these programs are required under the FERC license, but programs will change if natural production is established above the dams. The Hood River propagation programs are funded by the BPA through the Fish and Wildlife Program. This program will go through periodic review and could lose funding if priorities change or BPA reduces funding to the Fish and Wildlife Program. The Kalama River wild winter steelhead, Kalama wild summer steelhead, Sandy River late winter steelhead, and the Clackamas late winter steelhead programs are funded through Mitchell Act appropriations. Mitchell Act funding has continued to decline over time and future funding of these programs is uncertain.

18.3.4. Summary of Overall Extinction Risk Faced by the ESU:

The overall abundance of the ESU has increased since the previous status review, but the increase in natural spawning adults (both hatchery and natural-origin) is still well below historical abundances. Artificial propagation programs have supported increases in abundance in the Cowlitz River and Hood River basins. The proportion of hatchery adults that are allowed to

spawn naturally in the primary spawning areas in the Kalama River has not increased the overall abundance of the naturally spawning population. In the Sandy River and Clackamas River Basins, hatchery-origin winter steelhead are not passed upstream into the primary spawning habitat above the dams, but hatchery steelhead do support natural spawning in the areas below the dams. The Cowlitz River Basin re-introduction programs are attempting to increase the spatial distribution of the LCR steelhead ESU, but self sustaining populations have not been established. The integrated programs are operating to preserving genetic diversity. The continued release of non-ESU summer and winter steelhead into areas where natural populations are present remains a risk factor to the preservation of genetic diversity.

18.4 LITERATURE CITED

APRE reports. Artificial Production Review and Evaluation:

<http://www.apre.info/APRE/home.jsp> Select HGMP reports, select basin and program, password for all is apre.

BRT 2003. West Coast Biological Review Team. Updated Status of Federally Listed ESUs of West Coast Salmon and Steelhead. July 2003. Northwest Fisheries Science Center. Seattle, WA.

Clackamas River Late Winter Steelhead HGMP. 2001. Oregon Department of Fish and Wildlife. Salem OR. October 25, 2001.

Eagle Creek NFH Winter Steelhead HGMP. 2003. Eagle Creek Nation Fish Hatchery Hatchery and Genetics Management Plan. <http://www.nwr.noaa.gov/1hgmp/hgmppsmbmt.htm>

FHMP. 2004. Draft Cowlitz River basin Fish Hatchery Management Plan. Tacoma Public Utilities. Tacoma, WA. January 6, 2004 Draft.

HRPPR. 2003. Hood River Production Program Review. July 25, 2003 draft. Prepared by SP Cramer and Associates for the Bonneville Power Administration. Portland, OR.

Kalama Research Update. 2004. Email from P. Hewlett of WDFW. With update of Kalama River research activities part of October 2003 to March 2004 semi-annual report to NOAA Fisheries on Mitchell Act funded activities.

McElhany, P., T. Bachman, C. Busack, S. Heppell, S. Kolmes, A. Maule, J. Myers, D. Rawding, D. Shively, A. Steel, C. Steward, and T. Whitesel. 2003. Interim report on viability criteria for Willamette and Lower Columbia Basin Pacific salmonids. Unpublished report. NOAA Fisheries.

Sandy River Late Winter Steelhead HGMP. 2002. Oregon Department of Fish and Wildlife. Salem OR. March 6, 2002.

Tipping, J. 1996-1998. Cowlitz Fish Biologist Annual Reports. Washington Department of Fish and Wildlife.

WDFW Harvest Summaries. Washington Department of Fish and Wildlife Harvest Summaries:
<http://wdfw.wa.gov/fish/harvest/harvest.htm>

WDFW Hatchery Return Data. Washington Department of Fish and Wildlife:
<http://wdfw.wa.gov/hat/escape/escape.htm>

Wade, G. 2000. Salmon and Steelhead habitat limiting factors analysis. Water resource inventory are 26, Cowlitz Watershed. Washington State Conservation Commission. 203p.

Table 18.1. Artificial propagation programs affecting Lower Columbia River steelhead populations.

Ecological zone	Historical population	Artificial propagation programs integrated with historical population	Artificial propagation programs releasing non-ESU steelhead (segregated)	Included in ESU?	Program release (smolt unless otherwise noted)	Year initiated
Cascade Winter Run	Cispus River Winter Run	Cowlitz Late Winter Steelhead Program		Yes	Surplus adults only	1996
	Tilton River Winter Run	Cowlitz Late Winter Steelhead Program		Yes	Surplus adults only	2002
	Upper Cowlitz River Winter Run	Cowlitz Late Winter Steelhead Program		Yes	Surplus adults only	1996
	Lower Cowlitz River Winter Run	Cowlitz Late Winter Steelhead Program		Yes	390,000	1967
			Cowlitz Summer Steelhead Program	No	450,000	1967
			Cowlitz Early Winter Steelhead Program	No	300,000	1967
			Friends of the Cowlitz Summer Steelhead Program	No	100,000	
	Coweeman River Winter Run		Coweeman Ponds Winter Steelhead Program	No	20,000	1980
	South Fork Toutle River Winter		Cowlitz Game and Anglers Summer Steelhead Program	No	25,000	
	North Fork Toutle River Winter		North Toutle Summer Steelhead Program	No	25,000	1970
	Kalama River Winter Run	Kalama River Wild Winter Steelhead Program		Yes	45,000	1998
			Kalama Winter Steelhead Program	No	45,000	1995
	North Fork Lewis Winter Run		Merwin Winter Steelhead Program	No	100,000	1993
	East Fork Lewis Winter Run		E.F. Lewis Winter Steelhead Program	No	115,000	1957
	Salmon Creek Winter Run		Klineline Ponds Winter Steelhead Program	No	20,000	
	Washougal River Winter Run		Skamania Winter Steelhead Program	No	60,000	1957
	Clackamas River Winter Run	Clackamas River Late Winter Steelhead Program		Yes	155,000	1991
			Eagle Creek NFH Winter Steelhead Program	No	150,000	1956

Ecological zone	Historical population	Artificial propagation programs integrated with historical population	Artificial propagation programs releasing non-ESU steelhead (segregated)	Included in ESU?	Program release (smolt unless otherwise noted)	Year initiated
			Clackamas Summer Steelhead Program	No	175,000	1968
	Sandy River Winter Run	Sandy River Late Winter Steelhead Program		Yes	160,000	2000
			Sandy River Summer Steelhead Program	No	75,000	1976
Gorge Winter Run	Lower Gorge Tributaries Winter					
	Upper Gorge Tributaries Winter					
	Hood River Winter Run	Hood River Winter Steelhead Program		Yes	50,000	1991
Cascade Summer Run	Kalama River Summer Run	Kalama River Wild Summer Steelhead Program		Yes	60,000	1999
			Kalama Summer Steelhead Program	No	30,000	1997
	North Fork Lewis Summer Run		Merwin Summer Steelhead Program	No	175,000	1994
			Fish First Summer Steelhead Program	No	50,000	1997
			Speelyai Bay Net Pen Summer Steelhead Program	No	60,000	1997
	East Fork Lewis Summer Run		E.F. Lewis Summer Steelhead Program	No	25,000	1964
	Washougal River Summer Run		Skamania Summer Steelhead Program	No	60,000	1957
Gorge Summer Run	Wind River Summer Run					
	Hood River Summer Run	Hood River Summer Steelhead Program		Yes	40,000	1998
			Hood River Summer Steelhead Program (Skamania)	No	30,000	1987